

Gaming Workshop 11/8/99 – Differences between DWRSIM and DAILY OPS models

A. DAILY OPS Model Inputs:

1. Gaming with DAILY OPS model starts with historic inflows.
2. Modifications can be made to upstream releases to affect Delta inflow at Freeport (Sac) or Vernalis (SJ).
3. Monthly deliveries taken from DWRSIM study deliveries. Adding losses, subtract local supply, and evaporation to provide adjusted model deliveries. Adjustments come from DWRSIM. Includes interruptibles.
4. Originally used DWRSIM Freeport and Vernalis - now DAILY OPS adjusts with upstream models.
5. Options for adjusting starting conditions.

B. Daily Delta Modeling:

1. Starts with historical Delta inflow from Freeport and Vernalis.
2. Delta objectives from WQCP as in G Model - does not allow two-month lag. DWRSIM puts in 7000 cfs outflow in October to take care of chlorides.
3. Model matches standards with inflows - Impose standards on inflows.

C. Four limits on Pumping in DAILY OPS:

1. Use permitted capacity of pumps - 11,200 + 1/3 of SJ flow in winter.
2. Blue triangles in DAILY OPS output are pumping limits
3. Blue circles are E/I limits
4. Black triangles are delivery limits - San Luis limits

D. Model Comparisons

- Important comparisons between the models are monthly inflows and outflows.
- List of differences between the two models needed.
- Delta inflows are different level of development between the two models. We tested this in Game 5 - generally differences were small (<1000cfs). Inflows vary between studies - but are constant for daily model.
- Historic pumping by month in table in Daily Model includes DWRSIM inputs.
- DAILY OPS meets minimum 1500 cfs minimum - sometimes causes a deficit in outflow requirements. DAILY OPS does not adjust these to match current standards. Could ask for more water from reservoirs - but we have not been focused on upstream operations. We simply noted these exceptions. This is more important in drier years to make these decisions consistent with DWRSIM.
- Historic outflows are different for historic, DWRSIM, and DAILY OPS Model.

E. Differences between DWRSIM and DAILY OPS models:

1. Initial storages north and south.
2. Inflow to Delta (Freeport and Vernalis) - historic in DAILY OPS has Yolo flows.

3. Reservoir releases from Folsom, Shasta, New Melones, Oroville: DAILY OPS model has daily historical releases. Model raises historic releases to AFRP levels if necessary. Historic releases above AFRP are not changed. Adjusted for new flood control releases. Choice in gaming: could cut extra spring-summer historical releases if they were not prescribed or needed to meet Delta demands. Thus storage and releases could be different as requirements are different in the two models. End up the year the same. Flood control rules are important features that could be causing differences in the models.
4. Historic Delta depletions – DAILY OPS uses historic. Differences in depletions from Freeport to Keswick. DWRSIM includes GCID, ACID, etc. which may be different from the historic used in DAILY OPS Model. Trinity and Red Bluff depletions may be different. Daily model has historic depletions by river reach from gage data. DWRSIM has demand-based depletions.
5. Exports from Delta may be different. Could be a major source of difference.
6. Outflow required and total from the Delta may be different.

F. Comparison of Models

- Based on Study 3 without upstream changes, but includes Delta assets. Study 2 covers without b(2) and no new facilities- best for comparison with DAILY OPS baseline for WQCP.
- Note differences in many factors (e.g., Gridley Feather flows).

G. 1981 Simulation Differences:

- Outflow total: historic 7.8 MAF, DWRSIM 8.7 MAF
- Total difference in two models is about **800 TAF** of outflow for the year.
- Looking at Delta consumptive use for difference: DWRSIM 1196 TAF vs Daily 959 TAF. Thus even further off in inflow - 1 MAF.
- Looking at Freeport inflow: DWRSIM 12.5 MAF; Historic 11.5 MAF (assumed in DAILY OPS model). Differences by month were also large between DWRSIM and Historic. Probably from higher upstream reservoirs requiring flood control releases.
- Looking at Vernalis inflow: DWRSIM 1.808, historic 1.766, DAILY OPS - 1.81. Difference in monthly could be from New Melones operational plan. DWRSIM applies Stanislaus plan plus Tuolumne FERC flows. Step levels in VAMP requirements seems to be part of difference - whether 2500 step or 4500 step for April and May. DWRSIM had 4500 cfs support for VAMP.
- Yolo Bypass flow - DWRSIM 117 TAF vs Historic 124 TAF
- Eastside rivers flow - DWRSIM = 391 TAF vs Historic 287
- Total outflow numbers adding 200 for CCWD - match historic.
- DWRSIM doesn't use Day-Flow outflow - it calculates outflow. It uses Day-Flow inflow only.

Check Model balances:

- Models balanced inflow and outflow.
- Historic inflows outflows 13665 – 13665 for DAILY OPS.

- DWRSIM 14807 - 14807 include CCWD and North Bay

Total Annual Inflow Differences:

- DWRSIM had 1.2 MAF more inflow than DAILY OPS with exports roughly the same.
- Consumptive use within DWRSIM was several hundred TAF higher than historic. Plus 800 TAF more in outflow than DAILY OPS model (San Luis had filled early in DWRSIM).
- Looking at San Luis Storage in 1981 - DWRSIM starts at 1.8 MAF - DAILY OPS starts at 1.5; so DAILY OPS fills San Luis a month behind DWRSIM. DWRSIM ended at 524 TAF with DAILY OPS at -204. DWRSIM started 300 TAF higher and there was 400 TAF difference in allowable export.

Comparison of Monthly Inflow Differences:

- DWRSIM is getting more outflow (6000 cfs) in Jan-Mar period because of flood control releases upstream (indicates reservoirs had more initial storage).

Comparison of Upstream Requirements:

- Need to match river flows at Red Bluff and track net depletions upstream. And below Red Bluff. Control point at Red Bluff.

Comparison of Delta Requirements:

- COA in DWRSIM but not in DAILY OPS. DWRSIM determines allowable export with E/I and a 50/50 split of the allowable. Do COA calculations have any effect? - Only when E/I controls. CVP is forced to release more than they can pump. [NOTE: It will be hard to compare monthly COA effects with the DAILY COA simulation once Russ completes it.]
- Minimum flows in WQCP at Vernalis are not modeled in DWRSIM, but not a factor in the extra outflow in 1981.
- Monthly steps for VAMP in DWRSIM are simulated for half-month corrections, which may affect base flows and outflow totals, but not a factor in the extra outflow in 1981.

1981 Differences:

- DWRSIM starts San Luis Reservoir at 1.8 MAF compared to 1.5 MAF historically (and DAILY OPS).
- Required outflow was also higher in DWRSIM - flood control or accretions- hit flood control quicker than historic (and DAILY OPS).
- DWRSIM required outflow is quite different from DAILY OPS model. 4.6 MAF vs. 3.9 MAF for the year.
- X2 adjustments are made in DAILY OPS model, but not in DWRSIM. These adjustments caused a 5000 cfs difference in outflow requirements in April. So models differ in what is required for X2. For April DWRSIM had X2 outflow requirements when DAILY OPS model shows no requirement because of previous March extra outflow credits that are not modeled by DWRSIM.

- DWRSIM pumped 9000 cfs in early April before VAMP. How did DWRSIM meet outflow requirement in first half of April to have monthly average at 6000 cfs? DAILY OPS may model VAMP more accurately. DWRSIM pumps too much early in the month above the E/I limits.
- Difference is in allowable exports and target VAMP flow and exports.
- Study 2 VAMP is different in targets than DWRSIM. 30 day VAMP at San Joaquin River flow target.
- Storage reservoir differences upstream? Same flood control curves - but DAILY OPS model tracks them daily, which causes a difference with DWRSIM. DAILY OPS model has a problem with daily releases when flood limits are hit in a reservoir. Adjusted Freeport inflow from upstream reservoir changes should be built into the DAILY OPS Model baseline. DAILY OPS model likely needs to increase winter releases to take this into account. This would bring the models closer together. DWRSIM made larger monthly diversions from Trinity: 60-75 TAF of extra Trinity releases. DAILY OPS has big releases in May and DWRSIM does not. This was a 150 TAF flood control release in DAILY model - the need to release this can only be detected in the DAILY OPS model.
- Folsom: American River AFRP flows are not modeled in DWRSIM, whereas DAILY OPS does - 50 TAF of difference. Folsom storage on day 1 started the same in two models. B(2) gaming base has AFRP base. Study 2 did not. May and June releases on American are lower than historic. Indicates an extra 5000 cfs at Freeport must come from some other source than the American. By end of June the models are 230 TAF different in Folsom Storage. Are the May and June DAILY OPS releases exportable in the Delta? Are they balanced by Shasta releases? DAILY OPS model could be altered to hold more Folsom water back as DWRSIM did in May and June. 2000 cfs of release in June from Folsom should have been held in DAILY OPS Model. Note this makes the difference in Delta influences even larger - so this is not part of the problem with inflows.
- Oroville: started out 600 TAF ahead of historic level in 1981 in DWRSIM. DWRSIM had to spill over 500 TAF more than DAILY OPS model by April. [Obvious big part of inflow difference.] Thus sequence of years is extremely important in modeling. Also difference in the flood control curves. DAILY OPS model can be adjusted to start Oroville at the higher level. The initial storage difference accounts for most of the higher inflow to Delta changes we see from the Feather River.
- Trinity: Diversions from Trinity to Keswick are much higher in DWRSIM. High value power from Trinity is built into DWRSIM per BOR operating criteria. No operating policy for Trinity - not under OCAP. Does the Bureau dump Trinity water for power when it would be surplus water in the Delta?? DWRSIM does not allow this to happen. One more Rule - Clare Engle spill.
- Shasta: started the same in two models. At flood limit most of year until summer. Aug and Sept releases are 10,000 and 6,000 cfs respectively, which are much lower than DAILY OPS model and Shasta retains this water - question whether they can do this under winter run rules or AFRP requirements. 800 TAF in DWRSIM more at end of year in Shasta because of the lower releases (400 TAF) and more diversions from Trinity (400 TAF). 5000 cfs extra release in March for flood control in

DWRSIM higher than DAILY OPS because of differences in storage levels at beginning of water year.

- **Freeport inflow to Delta:** Jan and March inflows are higher in DWRSIM because of higher flood control releases upstream in DWRSIM than DAILY OPS.
- **Delta exports** under DAILY OPS are about 10% lower than DWRSIM because of daily restrictions versus monthly restrictions. Summer exports are about 25% lower for DAILY OPS despite exactly same inflows. Again this is due to daily accounting.

H. Summary and Conclusions

- Initial storage and flood control curves resulted in most of the differences in the two Models. But there were some other differences that allowed DWRSIM to export an additional 200 TAF. Plus some end of year storage differences.
- Agreed to game off of DWRSIM output.
- Match the daily and monthly averages to make the reservoirs levels track.
- This would also mean we are dropping out JPOD in the baseline in DAILY OPS model.
- Agreed to match Freeport flows to match upstream reservoirs.

Agreed to match San Luis changes by exporting the same amount from the Delta as DWRSIM (multiply deliveries by 1.35).

Fixes for DAILY OPS model:

- Include higher Delta deliveries (match DWRSIM monthly deliveries) and consumptive use (raise by 35%)
- Use DWRSIM flood control rules
- Use DWRSIM initial storage for reservoirs
- Delete AFRP upstream limits – use D1400 as DWRSIM
- Adjust Freeport inflows to match DWRSIM – this fixes upstream differences.
- Take out JPOD??
- Double step the VAMP to bring up May exports to DWRSIM level

Other Fixes:

Adjust Study 4 and game off that in DAILY OPS model.

Or run game off Study 3 with changes from above.

Consider gaming feedbacks from DAILY OPS to DWRSIM and gaming DWRSIM by month.

Questions:

What is the best way to do the daily gaming?

Do best we can for gaming using DAILY OPS with input from and feedback to DWRSIM.

Separately address model compatibility questions.